Remarks

This amendment is submitted in response to the Office Action of July 17, 2001. Reconsideration and allowance is requested.

In this office action, claim one was rejected over the combined teachings of Brown and Payton. This rejection is respectfully traversed.

In preparing our response to the office action, claim one has been cancelled, and claims 2-21 are submitted herewith. These claims describe an apparatus for stabilizing the spin access of a rotating system incorporated in a motor especially adapted to be incorporated in a disc drive. The motor includes either a separate winding, or the same winding as included in the motor but separately energized to damp out vibrations without disturbing or interfering with the operation of the motor means to create stable rotation for the disc for the disc drive. The invention comprises applying a force by superimposing an actuator current tending to drive the motor in a direction to damp out vibrations while simultaneously providing current sufficient to drive the motor in is normal actuated manner. The contributions of the actuator currents are arranged to provide the damping to cancel any vibrations, forcing the rotor to rotate in a direction which dampens radial movement and keeps the system stable.

The Brown patent completely fails to teach the claimed approach to damping vibrations, and specifically fails to teach providing or establishing a radial force applied to the motor so non-rotational movement can be dampened thereby. It fails to teach that the claimed structure, wherein the actuator relies on proper actuation with separate motor drive and vibration damping current supplied either to the same windings or separate windings which are wound over the separate phases of the motor to provide the damping function.

Further, while Payton may be alleged to suggest vibration canceling, like Brown he does not teach a motor having a separate windings for driving the motor and for active damping of induced vibration, or the application of separate sets of currents to achieve the same goal. In view of these distinctions, and the clear and accurate claiming of the invention in the claims now submitted, reconsideration and allowance of the claims is requested.

If any matters can be handled by telephone, Applicant requests that the Examiner telephone Applicant's attorney at the number below.

The Commissioner is authorized to charge any additional fees to Deposit Account No. 20-0782 (Order No. A-63367-1/JAS).

Respectfully submitted,

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VERSION WITH MARKINGS TO SHOW CHANGES MADE

In the Claims:

2. An apparatus for stabilizing the spin axis of a rotating system comprising a disc drive, said rotating system comprising:

a rotor carrying an inertial load comprising at least one disc and bearing means to support said rotor and said disc about said spin axis, and

motor means to cause rotation of said rotor about said spin axis comprising:

a first set of windings;

a source of drive current for causing relative rotation between said windings and said magnet; and

an actuator combined with a motor and comprising a source of actuator current energizing said windings to generate a radial force which stabilizes the position of said spin axis and dampens movements of said rotor and disc.

3. An apparatus as claimed in claim 2 wherein said first winding of said motor means is wound over a stator having a plurality of slots with each winding being wound about one of said slots.

4. An apparatus as claimed in claim 2 wherein said windings comprise at least first and second phase windings, which are separately wound and separately energized to generate two radial forces.

5. An apparatus as claimed in claim 4 wherein said motor includes a stator having a plurality of slots said winding being would over two of said slots.

6. An apparatus as claimed in claim 4 including circuit means for separately energizing each of said phases in order to modify the magnitude and direction of said radial force.

7. An apparatus as claimed in claim 6 including first and second probes associated with said rotor to measure a gyroscopic motion of said rotor or said shaft, output of said probes being processed to establish a signal applied to energize said first and second phase windings and stabilize said system.

8. An apparatus as claimed in claim 7 including means for adjusting the direction of said correction force relative to a reference direction corresponding to the position of said probes.

9. An apparatus as claimed in claim 8 including means for modifying the magnitude of said current applied to said first and second phases to adjust the magnitude of the correction force applied to said rotor.

10. An apparatus as claimed in claim 9 including a comb filter responsive to the output of said probe to separate components that are synchronous with the speed of said motor of said rotating system from components that are not synchronous with said motor speed and represent oscillatory movements of said rotor to be dampened.

11. Apparatus as claimed in claim 10 wherein said actuator current and said drive current are separately applied in time to said windings.

12. Apparatus as claimed in claim 11 wherein said actuator current and said drive current are simultaneously applied to said windings.

13. An apparatus as claimed in claim 6 wherein said motor has a slotless winding, and said windings of said actuator are concentric but placed in the same airgap between a core and the rotating magnets of said motor.

14. An apparatus as claimed in claim 6 wherein the magnitude of the actuator is a function of the current flowing in the two phases of the actuator where the relationship between the forces and the currents are defined as follows:

$F_x = k_f i_{ph1} \cos(p) + k_f i_{ph2} \sin(p)$

$F_y = k_f i_{ph1} \sin(p) - k_f i_{ph2} \cos(p)$

15. An apparatus for generating actuator currents for the apparatus of claim 6, including:

means for generating current signals as a function of rotor position;

means for multiplying said motor function currents by the respective detected forces, and means for summing said generated signals.

16. An apparatus as claimed in claim 2 further comprising;

means for sensing movements of said rotor;

comb means for separating non repeating movements from repeating movements of said rotor;

said actuator being responsive to said comb means to stabilize said rotor.

17. An apparatus as claimed in claim 16 wherein said actuator comprises first and second phase windings, which are separately wound and separately energized to generate two radial forces in quadrature.

18. An apparatus as claimed in claim 17 comprising means for generating a signal defining each of said currents having first and second input signals representing components of said radial force to be generated, and a third input representing motor position;

memory mans addressed with an argument of a function based on said rotor position for providing a trigonometric function based output based on said position; and

multiplier means responsive to said trigonometric function based output signal and said first and second input signals representing components of said radial force to generate elements of a said signal defining said currents.

19. An apparatus as claimed in claim 18 wherein said multiplier means comprises a digital/analog converter having said trigonometric based output signals as one input and one of said first and second signals representing said radial force as another input.

20. An apparatus as claimed in claim 19 including means for regularly resetting said signal generating means responsive to a motor driven pulse so that reset is proportional to motor rotational speed.

21. An apparatus as claimed in claim 20 including a circuit for incorporating an adjustable phase delay into said means for generating a current defining signal.